~~SECRET~~ 1
~~CONTROL~~
U.S. OFFICIALS ONLY

CENTRAL INTELLIGENCE GROUP

INTELLIGENCE REPORT

COUNTRY Yugoslavia

SUBJECT Discussion of Rocket Artillery

DIST. 13 November 1947

PAGES 6

SUPPLEMENT

ORIGIN

DISTRIBUTION

STATE	WAR	NAVY	JUSTICE		AAF					
X	X	X			X					

The following course in rocket artillery was given by a senior Soviet officer, a military instructor in the Yugoslav Army, to the students at the Officers' School in Belgrade.

The possibilities of military application of the principle of rockets. The possibilities of the application of the principle of rockets in the technique of war are not only varied, but of very old origin. The trials made before and during the war pertained to the following fields:

Portable rocket-launcher (bazooka) for the infantry
Portable rocket-launcher for chemical warfare
Rocket artillery with the field artillery - range of the projectile
Long-range artillery
Rocket motors as starters for aircraft
Rockets as projectiles against aircraft and as part of the armament of aircraft
Rocket bombs
Starters for one man torpedo boats and for other arms of the fleet

Uses of rockets by the Soviet Army up to the present time:

Portable rocket-launcher for the infantry and the rocket assault gun
Rocket-launchers, as 82mm, 132mm, and 400mm rocket artillery
82mm rocket launchers as part of airplane armament
Guided missiles propelled by rockets

Fundamental differences between the shot of a gun and that of a rocket

1. The gun shot

   a. The grenade shot from a gun is launched by means of the firing of the charge of the propulsion of the gun and ends its flight because of its own lack of propulsion. The range is determined by the development of the energy of the charge of propulsion, the relation between the weight of the of the shell and the weight of the charge of propulsion, as well as by the length of the barrel of the gun, that is to say, the time it takes for the gases released by the powder to act upon the projectile.

SECRET

b. The initial speed of the shell is the result of the behavior of gas in the cannon's interior, which is effected with the aid of a mechanism with motive force.

c. The elevation and the range of the projectile are determined by the exterior of the shell, by the weight and its resistance to air, as well as by the shape of the projectile, that is to say by its transversal density. In other words, the elevation is influenced by the relationship between the caliber, and the material of the projectile.

2. The rocket shot

a. The rocket projectile is self-propelled since it carries the necessary motive force with it. This force which launches and carries the projectile is produced by the combustion of a material which launches the rocket. The rocket projectile is composed of a grenade and of a charge which is placed behind the section which contains the grenade. The gases generated by the combustion of the propelling material are expelled at high velocity from the rear of the projectile and propel the projectile in the opposite direction.

b. The speed of the rocket projectile mounts gradually from one second to the other until the combustible material is consumed. Up to that moment the rocket projectile is impelled without interruption.

c. Considered purely theoretically the range of a rocket projectile will be, therefore, unlimited, but this is not the case. The method of producing the motive energy, the regularization of its ignition, the combustion, and the escaping of the gases, as well as the influence of the shell's exterior (which are a greater detriment than those of the shell of a gun) make a considerable obstacle by reason of the weight of that material which produces the propelling energy and which can increase range.

d. The outer efficiency of the rocket projectile, that is to say the relation between the kinetic energy of the charge and the range, is as important as the inner ratio of the projectile, that is to say the relation between the covering of the grenade and the contents of the explosive.

e. All the great powers are working feverishly to increase the range to unimaginable distances, to reduce dispersions to a minimum, and to increase the inner ratio of the rocket projectile.

3. The outer efficiency of the rocket projectile and of the charges of propulsion.

a. The value of the reaction charge which impels the rocket, consists of its effectiveness in creating combustion. This contents of energy is conveyed by the quantity of heat in kgcal/kg; the heat of the combustion of the material in mkg/kg. (sic).

b. The gases which produce the combustion expand to almost 10,000 times their volume which increases the speed of combustion and the quantity of energy delivered in a short time. Because of the rate of their detonation various explosive materials are used either as a way of propulsion or as an explosive. Because of these particular qualities all explosives cannot be used as ways of propulsion of rockets. Since they do not meet the requirements of a long period of combusion, the certainty of explosion can scarcely be guaranteed.

c. The greater the development of heat and speed of detonation, the greater is the danger of explosion. This disproportion between the duration of combustion and the thermodynamic effectiveness prevents the attainment of a greater range.

50X1-HUM

d. The following table contains certain information on the average contents of energy of combustible and explosive material:

Material	Kgcal/kg	mKg/Kg
Petroleum	11,500	4,910,000
Nitroglycerine	1,580	675,000
Nitroglycerine powder	920	393,000
Nitrocellulose powder	860	367,000
TNT	810	346,000
Black powder	685	292,000

Black powder which is poor in energy is not very effective as a material for propulsion. A mixture of nitroglycerine and nitrocellulose in a gelatin form is better. The highest propulsion charge in liquid form is benzine burned with liquid oxygen in the proportion 1 : 3.5.

e. The employment of small caliber rocket projectiles for the range covered by field artillery is not now being considered because of technical difficulties.

f. The propulsion medium for rocket projectiles now used by the Soviet Army for 82mm, 132mm, and 400mm rockets consists of a mixture of nitroglycerine and nitrocellulose with a combustion effectiveness of 880 kgcal/kg. The 82mm rocket projectile contains a charge of 1.031kg in the form of seven tubes of powder each with 147.3 grams, with a length of 228mm and with an opening 66mm in diameter and a lining of 9 mm. The 82 and 132mm rocket projectiles carry four fins as stabilizers and have openings on the tail of the rudder to allow for the escape of the gas. The conical angle of the point is 140°. The Russian rocket projectiles do not rotate around their axis which diminishes their efficiency.

The tail of flame of the Soviet rocket projectiles is a little longer. 50X1-HUM

4. The launching operation

a. Rocket projectiles, being self-propelled, do not need any heavy and complicated mechanism for launching. Only a simple trough is needed; the angle of departure is given corresponding to the direction and the length of the trough. The trough is, in general, very short since the charge attains its maximum energy very quickly after the electrical ignition.

b. The apparatus for both the 82mm and 132mm rockets have light cross rails in the form of a T. The channels of the trough are hollowed out on the top and on the bottom, and along the length they are fortified with a tail rounded into a tube. The teeth on the projectile catch in the notches of the tail rounded into a tube. After the lighting of the charge the projectiles move themselves by means of their teeth which catch on to the notches and in this way receive their direction of fire. The troughs in the form of a T carry two projectiles, one on top and on the bottom. Similar to regular guns, eight to eighteen of such double slides are mounted on a truck or on the chassis of an armored car. This aggregate of slides presents an easier method of transportation with the capability of aiming high, low and sideways.

(1) The elevation is + 20° - +45°.
(2) The traverse is limited and is received from the transportation.
(3) The lighting of the charge is electric.

c. The charging is very simple. The projectiles are slipped into the notches of the slide and are prevented from falling out by means of a latch. The ends of the electric cable are inserted into the lighting channels of the projectile, the tube is aimed and the preparations for fire are complete. 50X1-HUM

d. The projectiles can be discharged in salvos or two by two. The duration of a salvo amounts to eight seconds. The following models of slides are in use:

(1) For the 82mm: eight troughs for 16 projectiles
eighteen troughs for 32 projectiles (normal)
twenty-six troughs for 52 projectiles

(2) For the 132mm: eight troughs for 16 projectiles
twelve troughs for 24 projectiles (very rare)

(3) For the 400mm: a quadruple apparatus

5. Explosive projectiles with TNT charging and mixed nitroglycerine and nitrocellulose charging:

Rocket projectiles of Soviet Army	82mm	132mm	400mm
Length of the explosive head	230mm		
Weight of the explosive head	6.13kg	23.1kg	80kg
Muzzle velocity	50 meters per second	40 meters per second	
The maximum speed	350 meters per second		
Maximum horizontal range	6000 meters	9000 meters	2500 meters
Diameters - effect of explosion	6-7 meters	8-10 meters	
Diameter - effect of splinters	130 meters	200 meters	
Weight of the explosive charge	00.390 kg		

a. Information on dispersion does not agree. [redacted] 50X1-HUM dispersion from a salvo amounts to from 40 x40m to 60 x 60m. (36 rounds of the 82mm or 16 rounds of the 132mm). There is a mistake here as the dispersion of the 132mm rocket for a distance of 8500 meters at simultaneous round of

4 shots	50 meters in width	200 meters in depth
8 shots	350 meters in width	400 meters in depth
12 shots	500 meters in width	700 meters in depth
24 shots	700 meters in width	1200 meters in depth

[redacted] 50X1-HUM the degree of dispersion is very different. If one takes a large dispersion as a base, the result is that dispersion increases with distance and side dispersion with the simultaneous firing of salvos increases unequally with the dispersion in length.

Organization of rocket artillery

6. The groups of launchers are organized into batteries, sections and regiments.

7. The sections contain only one caliber of launcher and are protected against tanks by regular artillery, machine guns and rifles. The sections are usually organized into two or three batteries each with four launchers. The force of the section has the following fire-power:

M 8 section with six machines each with 36 rounds or 288 troughs
M13section with eight machines, each with 16 rounds or 128 troughs
M14 section with twelve machines, each with four rounds or 58 troughs

8. A regiment of two or three sections, therefore, comprises from 400 to 600 troughs according to its composition.

9. Batteries and light and heavy sections have one man for each trough and the heavy sections have two men for each trough.

50X1-HUM

Relationship between technical execution and tactical employment

10. Construction of the launching mechanism is very simple. The quality and quantity of material, the time necessary for construction and the possibilities of replacement are far superior as compared with artillery pieces. Preparation for the projectile offers equal advantages over the artillery shell, since the interior quality of the shell has less requirements. Rockets offer less precision since the dispersion is greater. The weight of the metal of the explosive head is less, but the explosive charge is larger. For the preparation of the projectile force more explosive material must be used than in cartridges, but no brass is needed in the manufacture of sockets for the projectiles. The weight of the launchers is several times less that of the lightest artillery pieces.

11. The range of rocket projectiles is about one half as great as corresponding pieces of field artillery. The slight weight of the apparatus, however, and the small crew of gunners make it possible to employ the rocket projectiles in advanced positions.

12. The apparatus for the rockets cannot touch artillery in the matter of precision, and so can never replace it. In regard to possible tactics the rocket apparatus offers a necessary complement to artillery. As to fire, when several real advantages of precision shooting become of less importance, the most salient characteristic of the artillery piece, namely the precision of shots, can be artificially reduced to nothing by the increase of dispersion while firing at various distances. In order to attain greater duration, not only should the muzzle velocity of the gun be very high, but also the number of necessary guns ought to be very great so as to maintain sufficient density of fire. The duration of the cone of fire increases the psychological effect of the attack, since the real effect of fire is greater if the duration permits no escape and no refuge. The duration of the cone of fire for bombardments of gas and of smoke is of special importance. The success of an attack depends to a considerable degree on the superiority of fire and of surprise. In defense success depends on up to the minute reconnaissance of the position from where the attack is being prepared. If surprised in the attack, the defense must depend on up to the minute reconnaissance of the attack's mission.

14. The fight against surface targets by massive employment is the real objective and the most important principle of rocket artillery. Specially in the mountains where there are barriers and passes protecting the known positions, the rocket mechanism assumes particular importance since it is light and possesses considerable force. The importance of duration of the cone of fire and of the short density is revealed again. Otherwise the round of fire can only be guaranteed by inconceivable masses of artillery. (sic).

Resume and Conclusion

15. The shot with one target in mind can be considered from the point of view of the quantity of ammunition or from the point of view of the time necessary to produce the shot. With the development of tactics the latter consideration assumes more and more importance. As the result of the development of technique the number of shots produced is related to the necessary expense of ammunition and to dispersion, that is to say, it depends on the duration of the cone of fire.

16. For tactical results the duration of the cone of fire plus the shot density is of decisive importance. Although for firing on solid targets (fortifications, artificial constructions, etc.), precision is of greater importance than the time when the desired result occurs, for firing on living targets which by their mobility escape the range or can take refuge, the time factor is far more important than for surface targets. The time factor is also of greater importance than high precision when the object is to create an obstruction to close off an area, or to create a disturbance. Nevertheless, it can happen that high precision guns which fire slowly can give the desired results. Tactical fire from swiftly operating weapons with not too accurate sighting can be highly successful despite great expense of ammunition.

17. Rocket artillery is an excellent arm for surface fire and for duration of fire. It can not replace normal artillery in regard to destructive and precision fire. Precise artillery pieces are not suitable for great density of fire in depth. Since a number of batteries sufficient to assure by sheer mass a great barrage and wide coverage cannot be deployed, a long time of fire is necessary. A terrible enemy of artillery is long firing time which occasions great losses in men and materiel.

18. For motor transport only light vehicles are necessary because of the slight weight of the rocket launching mechanism. The transport of ammunition is no more difficult than that of normal artillery. The equipment of the rockets when destroyed is easy to replace and repairs can be more quickly made than repairs on the intricate mechanisms of modern big guns.

19. Certain disadvantages of rocket artillery are found in the fewer possibilities for its use and because the combat position is quickly recognized because of the smoke. Corrections in aim are hardly possible while a round is in progress, but adjustments can be made for the next round. The expense of ammunition for a specified task is no greater than for normal artillery. The barrage is, moreover, ten times greater.

Rocket artillery is a precious and desired complement of artillery.